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REPORT

OF

THE DIRECTOR

OF THE

ROYAL OBSERVATORY, HONGKONG,

FOR THE YEAR

1923

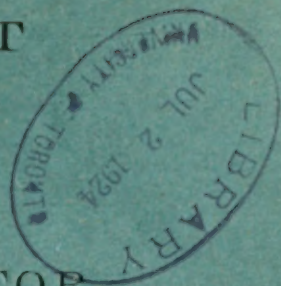


HONGKONG

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1924



REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1923.

I.—GROUNDS AND BUILDINGS.

The grounds were kept in order by the Botanical and Forestry Department with the assistance of the Observatory coolies.

In October two rows of iron shelves were fixed round the wall of the Old Time-Ball Tower to take the overflow of records from the Observatory.

The underground room for the seismograph and clocks was completed in the month of May. It consists of a double room with an air space of 2 feet between the inner and outer walls and roofs. The floor is 17 feet below the level of the ground. The inner room is 20 feet square and 10 feet 9 inches high at centre, with 9 inch brick walls.

The outer walls are of concrete, 2 feet 6 inches thick at the base tapering to 12 inches thick at the top.

Both roofs are of ferro-concrete. The outer roof is 4 feet below the level of the ground and is covered with disintegrated granite, which is turfed to the level of the surrounding lawn.

In the middle of the room is the seismograph pillar, a block of concrete 6 feet by 4 feet rising from a depth of 10 feet below the floor. The latter consists of 6 inches of lime and red earth concrete covered with 4 inches of cement concrete. It is not in contact with the pillar. The corners of the inner walls are bricked in so as to make the horizontal section an isosceles right-angled triangle, of which the hypotenuse is 4 feet. These will serve as pillars for the clocks.

A system of subsoil drainage is provided and ventilation is assisted by a 9 inch extract pipe, running to the roof of the Observatory, which connects with the air space between the inner and outer roofs. 18 inch cast iron grids are also provided at ceiling and floor levels to give air communication between the chamber and enclosing air space.

Steps leading from the verandah in front of the old Clock Room give access to the inner room through two pairs of swing doors four feet apart.

The room was very damp at first, the mean relative humidity in May being 96%. At the end of June five radiators were installed temporarily, and with the current on for 48 hours the relative humidity was reduced from 96% to 75%. On removing the

radiators, however, it increased again to 94% in 3 days, and remained between 90% and 97% until September 10, when the relative humidity of the outside air fell to 47%. In response the relative humidity in the basement fell to 75% on the 12th.

After fluctuating between 91% and 76% it fell to 58% on September 29 owing to another dry spell. The mean was 79% in November and 73% in December, occasionally increasing to 85% however.

The diurnal variation of temperature is negligible, as shown by the following table:—

Mean Temperature in Underground Chamber at 4 hourly intervals.

Month 1923.	Hour (H.K. Standard Time).					
	0	4	8	12	16	20
November,	75.28	75.23	75.24	75.25	75.27	75.23
December,	72.72	72.64	72.63	72.66	72.68	72.68

The annual variation is given below.

Mean Temperature in Underground Chamber from May to December 1923, compared with the temperature of the outside air.

Month.	Mean Monthly Temperature.	
	of Basement.	of Outside Air.
May,	73.2	77.8
June,	76.6	80.6
July,	79.7	82.0
August,	79.5	81.2
September,	79.3	81.1
October,	77.1	76.0
November,	75.3	71.6
December,	72.7	64.3

II.—METEOROLOGICAL INSTRUMENTS.

Barometers.—The Marvin compensated syphon barometer has required frequent attention. In the month of June a stiff wire 6 inches long was screwed into the armature of the buzzer and adjusted so as to vibrate the vertical wire on which the pen carrier slides. This has accentuated the action of the buzzer and kept the

recording parts in correct tension. At the same time the hourly time-break was made to work directly from the hourly signal current, as the original arrangement by which the hand of the barograph clock diverted the minute signal from the seismograph to the barograph, every 60th minute, was occasionally uncertain in its action.

The station barometer No. 1323 and the large Casella barometer were compared with the Observatory Standard on April 30.

Beckley Anemograph.—This instrument was oiled and the orientation of the vane checked once a month.

During the typhoon of August 18, the cups were caught in the antennæ of the wireless aerial, which were broken by the strong wind. They were repaired on August 23.

Dines—Baxendell Anemograph.—The bearings of the vane were oiled and its orientation checked once a month. The spindle of the float was cleaned and oiled once a week.

The Mean monthly results of comparisons with the records of the Beckley Anemograph from 1910-1922 are given in the following table, together with the results for 1923 :—

Factor for converting the actual run of the Beckley Anemograph cups to velocities recorded by the Dines Pressure Tube Anemograph.

Month.	Factor ($\text{Dines} \div \frac{\text{Beckley}}{3}$).	
	Mean 1910-1922.	1923.
January,	2'01	1'31
February,	2'06	1'40
March,	2'09	1'58
April,	2'11	1'58
May,	2'21	1'52
June,	2'10	1'69
July,	2'20	1'95
August,	2'21	1'95
September,	2'14	1'86
October,	2'07	1'86
November,	1'97	1'80
December,	1'95	1'50
Year,	2'09	1'67

Gap Rock Anemograph.—As the exposure of this instrument was found to be unsatisfactory, it was not returned to Gap Rock. It is proposed to mount it at Waglan early in 1924.

Thermometers.—All thermometers in use were compared with Kew Standard No. 647 in winter and summer.

A new Standard was obtained from Messrs. Gallenkamp in November. It reads $0^{\circ}04$ (F) lower than the Kew Standard, No. 647, at 60° F.

Hygograph for Underground Room.—In November a small dry and wet bulb hygograph, of the bi-metallic spiral type, was set up in the Underground Room. The record is obtained on a drum 5 inches high and $3\frac{1}{2}$ inches in diameter. Both dry and wet bulb records are time-scaled by an hourly signal from the mean time clock which operates an electro-magnet and causes the armature to engage in a toothed wheel concentric with the axis of the spiral thermometers. This moves the pen sufficiently to make a distinct mark on the paper, the record being quite smooth.

When the record shows rapid movements, such as in the case of an ordinary thermograph exposed to the outside air, the system of time-breaks is more satisfactory than time-marks.

Richard Thermograph.—The base lines laid down on the Richard thermograms from the hourly observations of rotating thermometers still show larger irregularities than might be expected, seeing that the thermograph is mounted in a well ventilated Indian pattern shed, and that the thermometers are aspirated automatically during the last five minutes of each hour.

III.—METEOROLOGICAL OBSERVATIONS AT THE OBSERVATORY.

Automatic records of the temperature of the air and evaporation were obtained with a Richard dry and wet bulb thermograph, and of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the report for 1912. The amount of rain is recorded automatically by a Nakamura pluviograph, the amount of sunshine by two Campbell-Stokes universal sunshine recorders, and the relative humidity of the air by a small Richard hair hygograph. Eye observations of barometric pressure, temperature of the air and of evaporation and the amount of cloud are made at each hour of Hongkong Standard time. The character and direction of the motion of the clouds are observed every three hours. Daily readings are taken of self-registering maximum and minimum thermometers.

Principal features of the Weather.—The principal features of the weather in 1923, were:—

- (a) Drought in January, February, March and May, and abnormally heavy rains in June, July, August and October.

- (b) Large number of typhoons; one of which, on August 18, caused considerable damage in Hongkong,
- (c) Abnormally high temperature in March, November and December.

Barometric pressure was moderately above normal in January, March and December, moderately below from April to July and considerably below in August and November. The mean pressure for the year at station level was $29\cdot828^{\text{ins}}$ as against $29\cdot820^{\text{ins}}$ in 1922 and $29\cdot842^{\text{ins}}$ for the past 40 years. The highest pressure was $30\cdot311^{\text{ins}}$ on December 30 as against $30\cdot445^{\text{ins}}$ in 1922 and $30\cdot509^{\text{ins}}$ for the past 40 years. The lowest pressure was $28\cdot590^{\text{ins}}$ on August 18 (the lowest on record) as against $29\cdot174^{\text{ins}}$ in 1922.

The temperature of the air was considerably above normal in March, November and December and moderately above in April and May. In the remaining months it was nearly normal. The mean temperature for the year was $72\cdot5$ as against $72\cdot4$ in 1922 and $71\cdot9$ for the past 40 years. The highest temperature was $92\cdot9$ on August 4, as against $93\cdot1$ in 1922 and $97\cdot0$ for the past 40 years. The lowest temperature was $45\cdot7$ on January 4 as against $43\cdot7$ in 1922 and $32\cdot0$ for the past 40 years.

The rainfall was moderately above normal in April, considerably above in July and very considerably above in August and October. It was considerably below normal in January, February, March and May. The total for the year was $106\cdot74^{\text{ins}}$ as against $69\cdot43^{\text{ins}}$ in 1922, and $84\cdot79^{\text{ins}}$ for the past 40 years. The greatest fall in one civil day was $11\cdot50^{\text{ins}}$ on October 31 and the greatest in one hour was $2\cdot82^{\text{ins}}$ between 1.30 a.m. and 2.30 a.m. on October 31.

The wind velocity was very considerably below normal in September, considerably below in February and moderately below in January, May, October and December. It was very considerably above normal in July and considerably above in August. The mean velocity for the year was 12.2 m.p.h. as against 11.6 m.p.h. in 1922, and 12.6 m.p.h. for the past 40 years. The maximum velocity for one hour, as recorded by the Beckley Anemograph, was 106 miles at 10 a.m. on August 18 as against 55 miles in 1922 and 108 miles for the past 40 years. The maximum squall velocity as recorded by the Dines-Baxendell Anemograph, was at the rate of 130 m.p.h. at 10h. 13m. a.m. on August 18 (the highest on record) as against 75 m.p.h. in 1922.

Rainfall at Four Stations.—In the following table the monthly rainfall for the year 1923 at the Observatory is compared with the fall at the Police Station, Tai Po; the Botanical Gardens; and the Matilda Hospital, Mount Kellet:—

Months.	Observatory (Kowloon).	Police Station (Taipo).	Botanical Gardens (Hongkong).	Matilda Hospital (Hongkong).
	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>
January,	0'130	0'53	0'21	0'20
February, ...	0'390	0'28	0'64	0'86
March,	0'660	0'40	0'84	0'60
April,	8'370	10'45	7'94	6'41
May,	3'795	4'49	4'36	3'86
June,	15'720	17'84	18'51	7'14
July,	18'525	28'57	20'43	11'58
August,	34'310	42'08	35'18	25'02
September,...	6'285	3'02	6'91	9'18
October,	17'835	9'00	12'84	18'05
November, ...	0'405	0'28	0'55	0'56
December, ...	0'315	0'08	0'63	0'54
Year,...	106'740	117'02	109'04	94'00

Floods.—The heaviest rainfall occurred at the Observatory as follows:—

<i>Period.</i>				<i>Amount.</i> inches.	<i>Duration.</i> hours.	<i>Greatest fall in 1 hour.</i>	
						<i>Amount.</i> inches.	<i>Time.</i> d. h.
April...12	3 to	April 13	21	5'26	30	2'17	April 12 5
May...30	1 to	June 4	19	4'50	54	0'61	June 1 18
June...12	11 to	June 15	9	7'45	37	1'19	June 14 10
July...20	18 to	July 23	10	6'29	32	0'60	July 23 5
July...26	5 to	July 31	20	9'61	59	0'81	July 27 13
Aug... 4	20 to	Aug. 6	10	6'86	32	0'83	Aug. 6 0
Aug...10	10 to	Aug. 19	4	10'55	35	1'25	Aug. 18 14
Aug...27	12 to	Aug. 31	14	15'87	76	1'58	Aug. 29 9
Oct. ...30	9 to	Oct. 31	9	16'09	22	2'82	Oct. 31 2

Serious floods and landslides were caused by these heavy rains.

Typhoons.—The tracks of 20 typhoons and 4 of the principal depressions which occurred in the Far East in 1923 are given in two plates in the Monthly Meteorological Bulletin for December, 1923.

IV.—PUBLICATIONS.

Daily Weather Report and Map.—A weather map of the Far East for 6 a.m. of the 120th meridian, and the Daily Weather Report (containing meteorological observations, usually at 6^h. and 14^h., from about 40 stations in China, Indo-China, Japan, the Philippines

and Borneo) and Daily Weather Forecasts for Hongkong to Gap Rock, the Formosa Channel, the south coast of China between Hongkong and Lamocks, and between Hongkong and Hainan, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Pier, Blake Pier, and the Harbour Office. One copy was sent daily to the Institute of Engineers and Ship-builders and one to the Director of the Meteorological Observatory, Macao. Forty copies of the Daily Weather Report were distributed to various offices, etc., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to the Hydrographic Office, Bangkok.

A charge of \$10 a year is made for supplying private firms and individuals with the Daily Weather Report, and \$36 for the Weather Map. No map was published on August 12, owing to the late arrival of weather telegrams. On several other occasions the map, though published, contained but meagre information.

The Weather Forecast is telegraphed daily to the Cape d'Aguiar Wireless Station in time for distribution at 1 p.m. It is broadcast again at 5 p.m.

An evening Weather Report and Forecast, based upon the 2 p.m., observations from about 30 stations, has been issued since June 1. It is broadcast by Cape d'Aguiar at 7 p.m., and repeated at 8 p.m.

Monthly Meteorological Bulletin.—The monthly Meteorological Bulletin, which includes the Daily Weather Report, was published as usual, and distributed to the principal observatories and scientific institutions in different parts of the world.

Monthly Seismological Bulletin.—The publication of a monthly seismological bulletin, giving particulars of earthquakes recorded by the Milne-Shaw seismograph, was continued throughout the year, and distributed to the principal seismological Observatories.

Miscellaneous Returns.—A monthly abstract of observations made at the Observatory is published in the Government Gazette, and monthly and yearly results are published in the Blue Book in the form suggested by the London Meteorological Office for the British Colonies. The monthly departures from normal of the barometric pressure at four China Coast Ports are communicated to the Commonwealth Meteorologist, Melbourne, in connection with long range weather forecasts. Monthly meteorological returns are forwarded to the Meteorological Magazine, and annual returns to the Stock Exchange Official Intelligence, the Colonial Office List and Whitaker's Almanack. Particulars of the calendar, eclipses, times of sunrise and sunset &c., are communicated to the "Directory and Chronicle" and the "Hongkong Dollar Directory."

V.—WEATHER TELEGRAMS, FORECASTS, AND STORM WARNINGS.

Daily Weather Telegrams.—The improvement in this service received a set back by the disastrous earthquakes near Yokohama on September 1—2. No weather telegrams were received from Japanese stations between September 1 and October 2.

On March 8 the service of weather telegrams from Wei Hai Wei ceased, owing to the closing of the Eastern Extension Telegraph Company's Office at this station, in view of the impending rendition of Wei Hai Wei. Through the courtesy of the Cable Company and the Chinese Maritime Customs this station was replaced by Chefoo from which weather telegrams have been promptly and regularly received since September 5.

A welcome addition to the list of telegraphic reporting stations is Basco, one of a group of islands midway between Luzon and Formosa. By the courtesy of the Director of the Philippines Weather Bureau observations from this station have been received, with few interruptions, since October 2, *via* Manila.

Occasionally belated weather telegrams are received from South China, but as a rule the observations from these districts are posted in batches to Hongkong, as are those from Central China.

Extra Weather Telegrams.—The following stations send extra weather telegrams at half rate during typhoons, on receipt of certain code words from Hongkong:—Amoy, Canton, Macao, Phulien, Sharp Peak, and Taihoiku. The Director of the Philippines Weather Bureau also sends extra telegrams, at his discretion, from Aparri or some other station nearer the typhoon centre. The extra 9 p.m. telegram from Swatow, kindly sanctioned by the Chinese Telegraph Administration during the typhoon season, was seldom received.

Weather Telegrams by Radio.—The following table gives the monthly number of ships from which radio meteorological messages have been received, and the number of messages received (each arrival and departure is counted separately):—

Month.	British including H.M. Ships).		Other National- ities.		Total	
	No. of ships.	No. of messengers.	No. of ships.	No. of messengers.	No. of ships.	No. of messengers.
January,	12	31	37	62	49	93
February,	6	13	31	64	37	74
March,	7	20	30	48	37	68
April,	13	23	35	49	48	74
May,	7	12	28	40	35	52
June,	13	36	33	51	56	87
July,	30	55	46	73	76	128
August,	32	67	49	86	81	133
September,	22	42	27	42	49	84
October,	13	26	41	73	54	99
November,	20	36	47	72	67	108
December,	19	48	25	41	44	89
Totals 1923,	196	...	431	...	627	...
Totals 1922,	280	...	369	...	649	...
Totals 1921,	121	...	145	...	266	...
Totals 1920,	64	...	76	...	140	...
Totals 1919,	17	...	44	...	16	...

It will be seen that while the number of foreign ships sending weather reports by radio telegraphy has increased by 17 ½, the number of British ships has decreased by 30 ½.

This is a serious matter which is engaging the attention of the Government.

Results of Weather Forecasts.—The results of comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years:—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1918	71	26	3	0
1919	71	27	2	0
1920	64	30	5	1
1921	65	30	5	0
1922	67	30	3	0
1923	66	30	3	1

The forecast comprises wind direction, wind force, and weather. Complete success means correct in three elements. Partial success means correct in only two elements. Partial failure means correct in only one element. Total failure means correct in no element.

The method of analysis is described in 1918 Report.

Storm Warnings.—At the request of the Chamber of Commerce the Hongkong Government adopted the China Seas Storm Signal Code from 1920, June 1, in place of the Hongkong Non-Local Code introduced in 1917. The signals are displayed on Kowloon Signal Hill.

The following Ports are warned by a telegraphic adaptation of the code:—Sharp Peak, Swatow, Amoy, Santuao, Macao, Canton, Wuchow, Phulien, Taihoku, Manila, Labuan, and Singapore. 218 storm warnings were sent in 1923 and 229 were received from Manila. 3 were received from Phulien, via Quang Chau Wan Radio Station.

Local typhoon signals are exhibited on the Observatory radio mast and repeated at the Harbour Office, H.M.S. *Tamar*, Green Island, the Godown Company, (Kowloon), Lyemun, and Lai Chi Kok, during the day.

The local night signals are exhibited on the Observatory Radio Mast and repeated on the tower of the Kowloon Railway Station, on H.M.S. *Tamar*, and at the Harbour Office.

A translation of the non-local and local storm warnings is exhibited at the Harbour Office, the General Post Office and the Star Ferry Piers and also sent to the Cape d'Aguilar Radio Station, whence it is broadcast at about noon and repeated every two hours until midnight. If a second warning is issued during the day the later warning is substituted.

When a local storm warning is displayed at the Observatory a cone is exhibited at several outlying stations for the benefit of native craft and passing ocean vessels.

In the following table is given the number of hours the local signal were hoisted in each of the years 1919-1923:

Year.	Red Signals.	Black Signals.	Bombs.
	Number of hours hoisted.		Number of times fired.
1919	78	135	1
1920	107	156	...
1921	94	121	...
1922	181	154	...
1923	181	252	2

The figures in the above table include the number of hours that night signals, corresponding to the day signals, were hoisted.

The red signal indicates that a depression exists which may possibly cause a gale at Hongkong within 24 hours. The black signals indicate that a gale is expected at Hongkong.

Three bombs fired at intervals of 10 seconds indicate that wind of typhoon force is anticipated.

VI.—METEOROLOGICAL OBSERVATIONS FROM SHIPS, TREATY PORTS, &c.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 178 ships operating in the Far East. These logs, representing 7139 days' observations, have been utilised for verifying typhoon tracks. The corresponding figures for the year 1922 were 172 and 5763.

Comparison of Barometers.—The corrections to ships' barometers are usually obtained by comparing their readings while at Hongkong with those of the Observatory Standard. Occasionally ship captains bring their barometers to the Observatory to be compared with the Observatory Standard.

VII.—MAGNETIC OBSERVATIONS.

Horizontal force, declination, and dip are observed once a month. In the dip observations 4 needles are used in rotation, the result for each month being the mean of determinations with two needles.

In the following table are given the annual values of the magnetic elements in 1923, as derived from observations made in the new magnetic hut with magnetometer Elliott 83 and dip circle Dover 71 :—

	1923.
Declination (west) - - - -	0.23.2
Dip (north) - - - -	30.44.7
Horizontal Force (C.G.S. unit) - -	0.37284
Vertical Force (C.G.S. unit) - -	0.22177
Total Force (C.G.S. unit) - -	0.43381

The Horizontal Force and Declination observations were made with Magnets No. 83 from January to May inclusive. On May 16 the lens and scale of the collimator magnet were accidentally fractured and Magnets No. 55 were used in unifilar Elliott No. 83 from June until the end of the year.

The damaged magnet was sent to England for repair in January 1924.

VIII.—TIME BALL.

Time Ball.—The Time Ball on Kowloon Signal Hill is dropped at 10 a.m. and 4 p.m., daily, except on Saturdays when it is dropped at 10 a.m. and 1 p.m., and on Sundays and Holidays when it is dropped at 10 a.m. only. (120th Meridian Time).

The Ball is hoisted half mast at the 55th minute and full mast at the 57th minute. If the ball fails to drop at the correct time it is lowered at 5 minutes past the hour and the ordinary routine repeated at the following hour, if possible.

When the Time Ball is out of order the above routine is carried out with flag “Z”, on the storm signal mast. On no occasion was the flag system required in 1923.

Time Signals are also given at night by means of three white lamps mounted vertically on the Observatory radio mast. From 8h. 56m. 0s. to 9h. 0m. 0s. p.m. the lamps are extinguished momentarily at the even seconds, except at the 2nd, 28th, 50th, 52nd, and 54th of each minute. The 9 p.m. signals were repeated at midnight on December 31, the last flash indicating the close of the year 1923. The hours refer to Hongkong Standard Time (8 hours East of Greenwich).

The Time Ball was dropped successfully 655 times. There was one failure: on November 23, when the handle of the winding gear was broken and it was impossible to raise the ball to the top of the mast by 10h. The handle was repaired by the Railway Department and replaced in time for the ball to be dropped at 16h. The ball was also dropped accidentally on November 20 at 15h, 57½m., but was raised and dropped correctly at 16h. On 9 occasions the ball was not raised owing to typhoon gales.

In the following table is given the number of times different errors occurred in the years 1922 and 1923,—

Error.	Number of Times.	
	1922	1923
0·3 sec. or less	633	654
0·4 "	10	29
0·5 "	6	12
0·6 "	2	7
0·7 "	...	4
0·8 "	1	...
0·9 "	1	2

The mean probable error of the time ball in each month for the past five years is given in the following table:—

Month.	Probable Error of the Time Ball.				
	1919	1920	1921	1922	1923
January,	±0·24	±0·17	±0·25	±0·10	±0·16
February,	·20	·30	·13	·15	·14
March,	·12	·21	·44	·12	·11
April,	·19	·15	·27	·20	·18
May,	·14	·17	·16	·10	·13
June,	·14	·13	·17	·11	·21
July,	·13	·22	·10	·14	·12
August,	·15	·11	·10	·10	·28
September,	·10	·24	·20	·15	·24
October,	·15	·15	·10	·10	·15
November,	·14	·19	·12	·17	·21
December,	·12	·15	·11	·10	·15
Means,	±0·15	±0·18	±0·18	±0·13	±0·17

Time Signal by Radio Telegraphy.—In addition to the time signals given by the Time Ball, and on the radio mast, signals are sent at 10h. and 21h. by radio telegraphy *via* Stonecutters. Particulars of the programme are given in the 1918 Report and in Government Notification No. 452 of 12.3.21. The service was transferred from Cape d'Aguilar to Stonecutters on May 1, 1921.

Radio Receiving Set.—The radio receiving set was in use throughout the year. 256 comparisons were obtained with the Manila Observatory clock *via* Cavite, and 5 with the Tokio Observatory clock, *via* Funabashi.

The mean of the comparisons makes Tokio 0.44 sec. fast and Manila 1.14 secs. fast on Hongkong. The corresponding figures in 1922 were 0.54 and 1.03.

Transit Instrument.—Observations for time were made chronographically by the Chinese computers, and were supplemented by eye and ear observations of the sun's limbs, circumpolar, and other stars made by the Chief Assistant for the purpose of checking the computers' observations, and determining the errors of the instrument.

The number of observations in the years 1922 and 1923 were as follows :—

	1922	1923
Transits - - - - -	1307	1424
Level determination - - - - -	696	787
Azimuth - - - - -	31	52
Collimation - - - - -	28	20

On January 11 the 3" transit instrument by Troughton and Simms was dismounted and sent to England for renovation by Messrs. Cooke, Troughton and Simms. A 2 $\frac{1}{4}$ " non-reversible transit by Dolland, kindly loaned by the Singapore Government, has been in use since that date. The observations made with this instrument by the Chinese computers have been extremely discordant and, in consequence, the pre-determination of clock errors has presented considerable difficulty.

Clocks.—The performance of the Standard Sidereal clock has been characterised by a steady increase in the daily losing rate for the past two years, apparently irrespective of any consideration of pressure, temperature or season. On November 8, 1923, the losing rate having increased to + 1.17 secs., 1.4 gramme was added to the pendulum. This altered the losing rate to—0.40 sec., which has since been maintained, with inconsiderable variations.

In the following table is given the excess of the observed over the computed error after cloudy periods during 1923 :

Date 1923.		Interval without observations.	Excess of observed over computed error.
			secs.
January	3	2 days	+ 0.02
"	15	4 "	- 0.45
"	22	3 "	+ 0.20
"	25	2 "	+ 0.19
February	14	6 "	+ 0.04
"	23	"	- 0.14
"	28	1 "	- 0.36
March	11	2 "	+ 0.24
"	16	4 "	+ 0.03
"	20	3 "	- 0.09
April	17	6 "	+ 0.15
"	22	3 "	+ 0.27
"	27	3 "	+ 0.25
May	3	3 "	+ 0.14
"	8	2 "	+ 0.39
June	4	3 "	+ 0.33
"	15	8 "	+ 0.09
"	27	5 "	- 0.10
July	5	5 "	+ 0.35
"	11	5 "	- 0.11
"	24	4 "	+ 0.11
"	31	5 "	+ 0.09
August	6	2 "	+ 0.24
"	20	10 "	- 0.95
"	23	2 "	- 0.49
September	2	"	- 0.52
"	15	2 "	+ 0.36
October	16	2 "	- 0.27
"	31	2 "	+ 0.27
November	16	2 "	- 0.33
"	26	2 "	- 0.18
December	3	3 "	- 0.42
"	10	4 "	+ 0.18

The Dent Mean Time clock (No. 39740) was used throughout the year for dropping the Time Ball, maintaining the electric time service in the Observatory, and sending hourly signals to the Railway, the Post Office, the Telephone Co., and the Eastern Extension Telegraph Co. The clock is corrected daily before 10 a.m. and before 4 p.m. by the electric regulating apparatus. The daily rate of the pendulum is kept below 0.5 sec. by the addition or removal of weights.

Chronometer Dent No. 40917 is on loan to the Stonecutters Radio Station.

Batteries, Power Supply, &c.—The necessary current for the Time Service has been supplied by accumulator batteries, charged as found necessary from the alternating mains of the China Light

and Power Co. Ltd., by a rotary converter. For rectifying alternating current the converter has proved more economical than Nodon Valves, which were used only for charging the high tension battery of the radio receiving set, for which purpose the converter is unsuitable. Becoming gradually less efficient the valves were finally discarded in July in favour of a Tungar rectifier, which has worked satisfactorily.

IX. — MISCELLANEOUS.

Seismograph.—The Milne-Shaw seismograph received in December, 1922, was set up on the west side of the seismograph pier in the newly completed Underground Room on May 3. It is orientated to record movements in an East-West direction. The instrument received in September 1921 remained on a temporary mounting until August 8, in order that its records might be compared with those of the new instrument on the underground pier. It was then set up parallel to the new instrument on the same pier.

An examination of the records showed that during an earthquake, the movements of the two pendulums side by side, though generally similar, were not identical.

The older pendulum was mounted in its final position at right angles to the other pendulum on September 3, thus completing the outfit for obtaining the north and east components of earth movements.

The result of comparisons of the records of the instrument on the temporary and permanent mountings is given below :—

<i>Phenomenon.</i>	<i>Temporary mounting.</i>	<i>Underground Pier.</i>
Diurnal Tilt.	Very marked : magnitude depending on daily range of temperature.	So small as to be usually unmeasurable.
Effect of typhoons.	Very marked : large irregular movements superposed on tremor storms.	Only slight tremor storms.
Tremor Storms.	Very marked : fairly frequent and occasionally lasting for several days at a time.	Very slight ; only occasional.
Irregular micro-seisms.	Very marked : fairly frequent and occasionally lasting for several days at a time.	Very slight ; only occasional.

So far as I am aware this is the first time that direct comparisons between two such mountings has been made, though it has generally been conceded that a solid pier in an underground room is necessary for the satisfactory registration of earth movements.

141 earthquakes were recorded during the year, as against 144 in 1922. The seismograms have been forwarded to the President of the Seismological Committee, Oxford.

Upper Air Research.—49 flights with pilot balloons were made during the year. The results of the observations have been sent to the *Commission International pour l'exploration de la haute atmosphere*, Kristiania.

Observations by the "tail" method have shown that the assumption of a constant rate of ascent is not justified. Observations with one theodolite therefore will not give results of the accuracy necessary in upper air research. An attempt is being made to secure observations with a second theodolite at a point about 3 miles to the NNW of the Observatory.

Staff.—No change occurred in the European staff. Mr. B. D. Evans, First Assistant, was on leave from February 21 to November 14.

Wan Suit Ngam, (IIIrd grade Telegraphist-computer) retired on January 31 and Lam Kai Tseung was promoted to IIIrd grade.

Lau Pak Wah and Chu Ip Sheung were promoted to Vth Grade on January 1. Chan Lai Man was appointed IVth Grade Telegraphist-Computer on 1922, December 7.

Expenditure.—The annual expenditure on the Observatory for the past ten years is as follows:—

Year.	Total Expenditure.	Increase.	Decrease.
	\$ c.	\$ c.	\$ c.
1914	25,398.31	1,142.82
1915	23,233.12	2,165.19
1916	21,977.78	1,255.34
1917	26,890.50	4,192.72
1918	20,028.24	6,862.26
1919	23,450.57	3,422.33
1920	25,965.66	2,515.09
1921	32,700.51	6,734.85
1922	38,350.10	5,649.59
1923	38,522.58	172.48

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T. F. CLAXTON,
Director.

1924, February 20.

